Alberto (Abraham) Gabizon (born 1951 in Tetuan, Morocco), received his medical degree at the School of Medicine in Granada, Spain, and his doctorate (PhD) in Cell Biology from the Weizmann Institute of Science in Rehovot, Israel. He completed his residency in Oncology at the Hadassah Medical Center in Jerusalem, and obtained the Israeli board certification in Radiation and Medical Oncology in 1985. Between 1985–1988, he spent three years on a research fellowship at the Cancer Research Institute of the University of California in San Francisco, where he helped to develop a new generation of long-circulating liposomes known as Stealth liposomes which have greatly improved stability and selective accumulation in tumors. Dr. Gabizon returned to Israel in 1989 as Senior Staff Physician and Investigator at the Sharet Institute of Oncology of Hadassah Medical Center where he continued his research and clinical activity until 2001. In 2002, Dr. Gabizon was appointed Chairman of the Oncology Institute at Shaare Zedek Medical Center, and Professor of Oncology at the Hebrew University-Faculty of Medicine in Jerusalem, his current appointment. Dr. Gabizon has received the Spanish National Prize of Medical Graduation (1975), the Career Research Award (1989) and Professorship Award (2008) of the Israel Cancer Research Fund, the Hebrew University Kaye Innovation Award (1997) for the invention 'Liposomal Doxorubicin for Cancer Treatment', and most recently the Alec Bangham Life Time Achievement Award of the International Liposome Research Society. Dr. Gabizon's research contribution placed a central role in the development of PEGylated liposomal doxorubicin (known as Doxil or Caelyx), a unique anticancer formulation extensively used in the clinic with important pharmacologic and safety advantages over conventional chemotherapy. Dr. Gabizon is active in the medical oncology field in early clinical trials, and in preclinical pharmacology research with special emphasis on applications of liposomes in drug delivery, targeting of drugs, and experimental cancer therapy, and has published around 120 original articles and specialized book chapters. Dr. Gabizon is a resident of Jerusalem, married and father of four children.

Biopolymers – Simply Natural?!

Linda Thöny-Meyer

Empa
Laboratory for Biomaterials, St. Gallen, Switzerland

The term biomaterial is often used explicitly in the context of medical applications, where biodegradability and biocompatibility play a critical role. In this presentation I will discuss examples of various classes of biopolymers with applications that are not exclusively related to a use in the body, *i.e.* for medical purposes. Such biopolymers span several families of substances, including polysaccharides, polyester, polyphenols, polynucleotides, and polypeptides. The huge reservoir of Nature's biopolymers with remarkable characteristics can be expanded by man-made technologies, leading to novel combinations of polymers or their building blocks in bio-derived polymers.

The sector of industrial ('white') biotechnology includes the production and engineering of biopolymers. At Empa we focus not only on the engineering of biomaterials for special applications but also on synthesis and production of novel biomaterials. Cellulose makes up 50% of the cell wall of plant cells where it provides stability and keeps the plants in shape. The Empa wood laboratory explores the production and application of nano-cellulose. By physical treatment natural cellulose fibers are broken down into nanofibrils which form networks of polymers with high surface area, which are rich in hydrophilic groups. The advantages of such nanofibrils in materials are their high stability, transparency, good barrier functions and their reactivity allowing chemical modification.

In the laboratory for biomaterials we change the characteristics of biopolymers in new combinations with additives in order to obtain material characteristics for special purposes, *e.g.* degradable materials in fields of textiles, packaging, agriculture and medicine. We also use biotechnology to produce polyesters and polypeptides from bacteria. Bacterial strains are engineered such that waste materials can be used for the production of cell mass. By applying special fermentation conditions we obtain high cell densities and improve yields. In addition we develop environmentally friendly procedures to isolate polyhydroxyalkanoate bioplastics in medical grade. The obtained material is used for medical but also biological applications. Enzymes involved in synthesis, degradation or conversion of biopolymers are cloned, produced and engineered in our laboratory. An example is tyrosinase, the key enzyme of melanin biosynthesis, which has further applications such as protein immobilization.

Biopolymers comprise polymeric materials that are either bio-based, *i.e.* made by natural processes from natural sources, or that can be degraded by natural processes. In times when petrochemical resources become more limited, or are regarded ecologically problematic, these sustainable materials are expected to become more and more important and economically competitive.

Linda Thöny-Meyer has been the head of the Laboratory for Biomaterials at Empa since 2006. She performs R&D in the field of biopolymers and biocatalysis. She graduated 1988 at ETH Zürich with honors. After postdoctoral activities at Stanford University she habilitated in 1997 and became an assistant professor for Molecular Microbiology at the Institute of Microbiology, ETH Zürich. 2004–2006 she worked as a patent attorney for E. Blum & Co in Zürich. For her research contributions she obtained several awards including the title of an honorary doctor from Lund University, Faculty of Sciences, where she also served in the Scientific Advisory Board.

Synthetic Biomembranes

Wolfgang Meier and Nico Bruns

Department of Chemistry of the University of Basel
Basel, Switzerland

Similar to conventional lipids, suitable amphiphilic block copolymers may self-assemble in aqueous media to membrane-like superstructures. The physical properties of these membranes can be controlled to a large degree via the chemical constitution,

the molecular weight and the hydrophilic-to-hydrophobic block length ratio of these polymers. Compared to conventional low molar mass building blocks (*e.g.* lipids), membranes based on macromolecular self-assembly not only have the advantage of superior stability and toughness, but in addition offer numerous possibilities of tailoring physical, chemical and biological properties since many functions can be implemented simultaneously in one single macromolecule.

Moreover, other well-defined functions such as recognition, cooperativity, regulation, replication, and catalysis can be introduced by combining these superstructures with suitable functional groups from nature, *e.g.* by incorporation of integral membrane proteins into the biomimetic membranes. Recently, we used this concept to prepare polymer nanoreactors by encapsulating water-soluble enzymes inside the aqueous compartments of block copolymer vesicles. Channel proteins were used to selectively control the exchange of substrates and products with the environment. Immobilized polymer nanoreactors were used as chemically and mechanically stable, nanometer-sized compartments to follow folding/unfolding of single proteins and to monitor enzymatic reactions down to a single nanoreactor scale. Model reactions were used to demonstrate the potential of these structures for biosensing and the local production of bioactive compounds. In addition, these nanoreactors can be targeted to predefined cells. After cellular uptake, they retain their function over extended times inside the living cells, thus acting as a sort of artificial organelle. This opens new ways for controlled drug delivery and intracellular sensing.

Wolfgang Meier studied Chemistry at the University of Freiburg and received his PhD degree in Macromolecular Chemistry in 1992. In 1996 he was appointed as lecturer in Physical Chemistry at the University of Basel where he received his 'Habilitation' in 1998. In 2001 he was appointed as professor at the International University of Bremen and since 2003 he is Professor of Chemistry at the University of Basel. He received several awards (Ruzicka-Prize, 2001; Hermann-Staudinger-Prize, 2006) for his research.
His main research interests are in the field of hierarchical self-assembly of functional polymers, and polymer-protein hybrid materials.

Nico Bruns is currently a 'Habilitand' (research group leader) at the Department of Chemistry at the University of Basel. He studied Chemistry at the Universities of Freiburg and Edinburgh. He received his PhD in Macromolecular Chemistry in 2007. He then spent one and a half years as a postdoctoral researcher at the University of California, Berkeley, after which he came to Basel to establish his own line of research and his own research group. He received a scholarship from the German National Academic Foundation (Studienstiftung des deutschen Volkes), a Marie Curie Intra European Fellowship, as well as several awards, *e.g.* the Pfizer-Research Award for Young Scientists. His research interests include cage-like proteins as nanoreactors and functional nano-devices. He is also investigating polymer-protein hybrid materials and amphiphilic copolymer systems.